

WHAT IS CLAIMED IS:

1. An electrically operated solenoid for controlling a mechanical device,
comprising:

a coil assembly defining an interior region extending along an actuation axis;

5 an armature member adapted for reciprocating movement along said actuation
axis and defining a first passage extending therethrough;

a pole piece member at least partially disposed within said interior region of
said coil assembly and defining a second passage extending therethrough generally
aligned with said first passage in said armature member;

10 a shaft member having a first portion disposed within said first passage in said
armature member and a second portion extending through said second passage in said
pole piece member for engagement with the mechanical device, said shaft member
engaged with said armature member such that said reciprocating movement of said
armature member correspondingly displaces said shaft member through said second
15 passage in said pole piece along said actuation axis to control operation of the
mechanical device; and

an adjustment member extending into said first passage in said armature
member and into engagement with said first portion of said shaft member, said
adjustment member displaceable along said first passage in said armature member to
20 correspondingly adjust a position of said shaft member relative to said armature
member along said actuation axis.

2. The solenoid of claim 1, wherein said second portion of said shaft
member is guidably displaced along said second passage in said pole piece member
25 during said reciprocating movement.

3. The solenoid of claim 1, wherein said second portion of said shaft member is supported substantially entirely along said second passage in said pole piece member during said reciprocating movement.

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4. The solenoid of claim 1, wherein said second portion of said shaft member has an outer cross section sized and shaped in relatively close tolerance with an inner cross section of said second passage in said pole piece member.

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5. The solenoid of claim 1, wherein said first portion of said shaft member is supported within said first passage in said armature member along substantially an entire length of said first portion.

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6. The solenoid of claim 1, wherein said shaft member has a substantially uniform outer cross section sized for displacement entirely through said second passage in said pole piece member and said first passage in said armature member to allow for removal of said shaft member from the electrically operated solenoid.

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7. The solenoid of claim 1, wherein said armature member and said shaft member comprise a two-piece actuator member having an effective length; and wherein displacement of said adjustment member along said first passage in said armature member correspondingly adjusts said effective length of said two-piece actuator member, adjustment of said effective length accomplished while the electrically operated solenoid remains in engagement with the mechanical device.

8. The solenoid of claim 1, wherein said adjustment member comprises a threaded member engaged within a threaded portion of said first passage in said armature member; and

5 wherein threading of said threaded member along said threaded portion of said first passage correspondingly adjusts said position of said shaft member relative to said armature member along said actuation axis.

9. The solenoid of claim 8, further comprising a thread locking material
10 applied to said threaded member prior to engagement within said threaded portion of said first passage, said thread locking material inhibiting rotation of said threaded member to lock said shaft member in a select position relative to said armature member.

15 10. The solenoid of claim 1, wherein an end portion of said shaft member engages the mechanical device adjacent one end of the electrically operated solenoid, said adjustment member positioned within said first passage in said armature member adjacent an opposite end of the electrically operated solenoid.

20 11. The solenoid of claim 1, wherein said adjustment member is entirely disposed with an interior region of the electrically operated solenoid.

12. The solenoid of claim 1, further comprising an outer housing defining a passageway extending therethrough along said actuation axis between a first end
25 and an opposite second end, said adjustment member positioned within said

passageway adjacent said first end of said outer housing, said second portion of said shaft member extending along said interior region of said coil assembly and into engagement with the mechanical device adjacent said second end of said housing.

5 13. The solenoid of claim 12, further comprising a cap member removably positioned over said passageway adjacent said first end of said outer housing to selectively cover said passageway.

10 14. The solenoid of claim 13, wherein said cap member comprises a non-threaded button member.

15 15. The solenoid of claim 14, wherein said non-threaded button member includes a lip portion received within a retention groove formed adjacent said first end of said outer housing to selectively retain said non-threaded button member in engagement with said outer housing.

20 16. The solenoid of claim 1, further comprising a stop member, said armature member disposed between said stop member and said pole piece member to limit said reciprocating movement of said armature within a predetermined range of movement.

25 17. The solenoid of claim 16, wherein said stop member defines an opening extending therethrough to provide unrestricted access to said adjustment member.

18. The solenoid of claim 16, wherein said stop member is removably engaged with the electrically operated solenoid to provide for removal of said armature from the electrically operated solenoid.

5 19. The solenoid of claim 1, wherein said interior region of said coil assembly is bounded by an inner cylindrical surface defining a substantially uniform inner diameter, said armature member having an outer diameter sized in relatively close tolerance with said inner diameter of said coil assembly to guide said armature member along said actuation axis during said reciprocating movement.

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20. An electrically operated solenoid for controlling a mechanical device, comprising:

a bobbin defining an interior region extending along an actuation axis;

an energizing coil wire wound about an exterior region of said bobbin;

15 a plunger adapted for reciprocating movement along said actuation axis, said plunger defining a first passage extending therethrough, said first passage including a threaded portion;

a core at least partially disposed within said interior region of said bobbin and defining a second passage extending therethrough generally aligned with said first
20 passage in said plunger;

an actuator pin having a first portion disposed within said first passage in said plunger and a second portion extending through said second passage in said core for engagement with the mechanical device, said actuator pin engaged with said plunger such that said reciprocating movement of said plunger correspondingly displaces said
25 actuator pin through said second passage in said core along said actuation axis to

control operation of the mechanical device; and

an adjustment screw threadingly engaged within said threaded portion of said first passage in said plunger and engaged with said first portion of said actuator pin, said adjustment screw being threadable along said threaded portion of said first passage to correspondingly adjust a position of said actuator pin relative to said plunger along said actuation axis.

21. The solenoid of claim 20, wherein said second portion of said actuator pin is guidably displaced along said second passage in said core during said reciprocating movement.

22. The solenoid of claim 20, wherein said second portion of said actuator pin is supported substantially entirely along said second passage in said core during said reciprocating movement.

23. The solenoid of claim 20, wherein said first portion of said actuator pin is supported within said first passage in said plunger along substantially an entire length of said first portion.

24. The solenoid of claim 20, wherein said plunger and said actuator pin comprise a two-piece actuator member having an effective length; and

wherein displacement of said adjustment screw along said first passage in said plunger correspondingly adjusts said effective length of said two-piece actuator member, adjustment of said effective length accomplished while the electrically operated solenoid remains in engagement with the mechanical device.

25. An electrically operated solenoid for controlling a mechanical device, comprising:

an outer housing extending along an actuation axis between a first end and an opposite second end;

5 a coil assembly defining an interior region having a length extending along said actuation axis;

a plunger adapted for reciprocating movement along said actuation axis and defining a first passage extending therethrough;

an actuator pin having a first end portion disposed within said first passage in
10 said plunger and a second end portion extending along said interior region of said coil assembly for engagement with the mechanical device adjacent said second end of said housing, said actuator pin engaged with said plunger such that said reciprocating movement of said plunger correspondingly displaces said actuator pin along said actuation axis to control operation of the mechanical device; and

15 an adjustment member extending into said first passage in said plunger adjacent said first end of said housing and into engagement with said first portion of said actuator pin, said adjustment member displaceable along said first passage in said armature member to correspondingly adjust a position of said actuator pin relative to said plunger along said actuation axis.

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26. The solenoid of claim 25, further comprising a core at least partially disposed within said interior region of said coil assembly and defining a second passage extending therethrough generally aligned with said first passage in said plunger, said actuator pin extending entirely through said second passage in said core
25 for engagement with the mechanical device adjacent said second end of said housing.

27. The solenoid of claim 26, wherein said actuator pin is guidably displaced along said second passage in said core during said reciprocating movement.

28. The solenoid of claim 26, wherein said actuator pin is supported
5 substantially entirely along said second passage in said core during said reciprocating movement.

29. The solenoid of claim 25, wherein said first end portion of said actuator pin is supported within said first passage in said plunger along substantially
10 an entire length of said first end portion.

30. The solenoid of claim 25, wherein said plunger and said actuator pin comprise a two-piece actuator member having an effective length; and
wherein displacement of said adjustment member along said first passage in
15 said plunger correspondingly adjusts said effective length of said two-piece actuator member, adjustment of said effective length accomplished while the electrically operated solenoid remains in engagement with the mechanical device.

31. The solenoid of claim 25, wherein said adjustment member is entirely
20 disposed with an interior region of said outer housing.

32. The solenoid of claim 25, further comprising a stop member disposed adjacent said second end of said outer housing to limit said reciprocating movement of said plunger, said stop member defining an opening therethrough to provide
25 unrestricted access to said adjustment member.

33. The solenoid of claim 25, further comprising a cap member removably
5 positioned over a passageway formed adjacent said first end of said outer housing to
provide selective access to said adjustment member.

34. The solenoid of claim 33, wherein said cap member comprises a non-
threaded button member having a lip portion received within a retention groove
10 formed adjacent said first end of said outer housing to selectively retain said button
member in engagement with said outer housing.

35. The solenoid of claim 25, wherein said outer housing comprises an
encapsulation material.